OPERATION MANUAL

CE-71
SPECTRUM
DISPLAY

Cushman
Electronics, Inc.

MP MASTER
MA31777

Applicable to all units

CE-71
SPECTRUM DISPLAY

OPERATION MANUAL

CUSHMAN
ELECTRONICS, INC.

5601**0070**1

MAY 1977

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CUSHMAN INSTRUMENT WARRANTY

All instruments manufactured by Cushman Electronics, Inc. are warranteed against defects in material and workmanship for a period of one year from the date of original shipment. Cushman will repair or replace instruments, which prove to be defective, in accordance with the following policy. This policy does not apply to repair service, parts sales, nor does it apply to instruments, or parts of the instrument, which in the opinion of Cushman, have been altered or misused.

All Countries

- During the first three months after the date of original shipment, no charge for parts, replacement PC boards, labor, or freight for instruments serviced at an authorized Cushman Service Center. Free freight applies only within the customer's country. Method of transportation shall be designated by an authorized Cushman representative or Service Center.

- During the fourth through the twelfth month after the date of original shipment, no charge for parts, replacement PC boards, and labor for instruments serviced at an authorized Cushman Service Center. All transportation charges for instruments, parts, or replacement PC boards shall be paid by the customer during this period.

- Replacement PC boards during the first year are warranteed only when the defective boards have been identified by an authorized Cushman Service Center and the defective PC board is returned in accordance with Cushman's exchange board policy.

U.S.A. and Canada

In the U.S.A. and Canada an additional two year limited warranty is offered extending from the 13th until the 36th month from the date of original shipment. This warranty is effective beginning with instruments purchased on or after April 1, 1977. During this period, the following limited warranty policy applies:

- No charge for parts* used by an authorized Cushman Service Center to repair an instrument.

- Cushman will replace at no charge, PC boards which are found to be defective by an authorized Cushman Service Center. Defective boards must be returned to Cushman in accordance with Cushman's PC board exchange policy.

- All transportation charges for instruments, parts, and replacement PC boards shall be paid by the customer during this period.

* Cathode ray tubes and batteries excluded.

CUSHMAN
ELECTRONICS, INC.

CUSHMAN CE-71

SPECTRUM DISPLAY

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Figure 1. CE-71 Spectrum Display

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1. GENERAL

INTRODUCTION

1.01 The Cushman CE-71 is a companion unit to the Cushman CE-70 only, or to the CE-70 and CE-72 which work together to provide a complete Transmission Test System. It displays the frequency spectrum of any part of the base band for analysis and troubleshooting of FDM carrier communications systems.

1.02 The spectrum display can assist in rapidly identifying and analyzing many parameters of FDM carrier systems such as high level tones, spurious fluctuation noise, missing pilot tones, and incorrect pilot frequencies or levels. It is also useful for interpretation of data signals, and for swept frequency response measurements.

DESCRIPTION

Operating Features

1.03 The CE-71 has six calibrated sweep widths which cover 1, 12, 60, 600, 1800 or 3600 channels. These sweep widths correspond to bandwidths of 4 kHz, 60 kHz, 300 kHz, 3 MHz, 10 MHz and 25 MHz.

1.04 The display levels are logarithmic. In the 10 dB per division mode they cover a range of -20 dB to +40 dB (60 dB range) referred to 0 dB on the meter of the CE-70. An expanded range of 1 dB per division is also provided. Using this range any vertical 6 dB segment of the received signal may be examined.

1.05 Two other features are a marker and a Hi-Level Alarm. When the marker is switched on a vertical line pulse appears on the trace at the frequency to which the Selective Levelmeter is tuned. This makes it possible to determine the frequency at any point on the displayed bandwidth.

1.06 The Hi-Level Alarm is used to monitor a signal for amplitudes above a given level. When the peak of the signal is set to the 0 dB line on the CE-71 graticule by adjusting the CE-70 Level or CE-71 Vertical controls, amplitudes above this level for three successive sweeps will trigger an ALARM light on the front panel. (Not meaningful if 0 Hz signal is within the frequency band swept.) At the same time a relay is closed. The floating contacts of this relay are available at a pair of rear panel binding posts. Relay contact closure indicates the alarm condition. Any desired type of alarm indicator, within the electrical limitations of the relay contacts, may be connected to these binding posts.

1.07 The actual level of the signal displayed depends on the setting of the level controls on the CE-70. After the CE-71 has been calibrated to the CE-70 (see operating procedure) the 0 dB line on the CE-71 graticule corresponds to the Level set by the CE-70 Level controls.

1.08 The CE-71 may also be used with the CE-70 and the CE-72 to form a Transmission Test System (TTS). In this system the CE-72 output is either a signal at a single frequency to which the CE-70 is tuned, or it is swept across the band to which the CE-71 is set by the CE-71 LO, or the CE-72 may be disconnected from the system and be independently set to any desired frequency within its range. The CE-71 provides the swept Local Oscillator signal to both the CE-70 and the CE-72 in the sweep mode. The center frequency of the swept band is the frequency to which the CE-70 is set, except when the CE-71 sweeps the entire band. Using the marker and the Horizontal Position control this frequency may be set to the center of the graticule. With this system transmission loss or frequency response over one channel or up to 3600 channels may be determined, either by sweeping the whole bandwidth or sweeping individual channel slots. When the CE-71 is connected to the CE-70 and is in the SWEEP mode, the CE-70 BFO output (at 0 dBm) is swept by the CE-71. This BFO output may be used in place of the CE-72 for swept displays. Switches on the CE-71 permit disconnecting the CE-70 and the CE-72 from the system so that they may operate as independent units, while still connected as a TTS system.

1.09 Three sweep modes are available, either a continuously repeating sweep, a single sweep triggered at will, or a manually adjusted sweep. The single sweep is used to photographically record a display. In the manual sweep mode the CRT beam is moved across the display by the CE-71 TUNE control to make possible the close examination of any particular feature of the displayed trace.

Physical Description

1.10 The physical size of the CE-71 is 7 3/4" H x 17 3/4" W x 22" D. The weight is 45 lbs. The power required for operation is 115/230V AC (switch selectable at the rear panel) at 50-60 Hz. Nominal AC input is 70 VA.

Characteristics

1.11 The characteristics of the CE-71 are given in detail in Table A.

Accessories

1.12 The following accessories are provided with the CE-71:

4	Coaxial Cables, 13", BNC to BNC	7034-0605
1	Coaxial Cable, 21", BNC to BNC	7034-0606
1	CRT Viewing Hood	2180-0130
1	Instruction Manual, Operation	5601-0070
1	Instruction Manual, Maintenance	5601-0069

TABLE A

CE-71 SPECIFICATIONS

ITEM	CHARACTERISTICS		
FREQUENCY			
Range	1 kHz to 25 MHz		
Sweepwidths (fixed, switch selected)	25 MHz, 10 MHz, 3 MHz, 300 kHz, 60 kHz, 4 kHz		
Marker Accuracy	±2% of full scale		
Resolution	0 dB	20 dB	50 dB
25 MHz	250 kHz	350 kHz	500 kHz
10 MHz	100 kHz	150 kHz	200 kHz
3 MHz	30 kHz	40 kHz	50 kHz
300 kHz	5 kHz	10 kHz	15 kHz
60 kHz	1 kHz	2 kHz	4 kHz
4 kHz	100 Hz	200 Hz	500 Hz
LEVEL			
Range			
Input (for 0 dB level on display)	-109 dBm to +10 dBm		
Display (ref. to 0 dB reading on CE-70)	60 dB logarithmic, +40 dB to -20 dB		
Accuracy (at -40 dB, after CAL to CE-70 in sweep mode in which measurement is to be made)	Same as CE-70		
Frequency Response	±0.1 dB additional to CE-70 specifications		
Display Linearity (vertical deflection)			
10 dB/DIV mode	±2 dB		
1 dB/DIV mode	±0.5 dB		
INTERNAL DISTORTION	See CE-70 specifications		

TABLE A (Cont)

CE-71 SPECIFICATIONS

ITEM	CHARACTERISTICS
SPURIOUS RESPONSES (Referred to 0 dB on display)	
CE-70 Tone Mode	
0 to 20 dB overdrive	<-15 dB
20 to 40 dB overdrive	<-10 dB
CE-70 Noise Mode	
0 to 20 dB overdrive	<-8 dB
20 to 40 dB overdrive	<-5 dB
IF BANDWIDTH (Nominal)	
Sweepwidth	
25 MHz, 10 MHz, 3 MHz	
3 dB	5 kHz
60 dB	75 kHz
300 kHz	
3 dB	1.5 kHz
60 dB	15 kHz
60 kHz	
3 dB	400 Hz
60 dB	4 kHz
4 kHz	
3 dB	45 Hz
60 dB	450 Hz
SWEEP RATE (Nominal)	
Sweepwidth	
25 MHz	0.4 Hz (2500 ms period)
10 MHz	1.0 Hz (1000 ms period)
3 MHz	2.2 Hz (450 ms period)
300 kHz	2.2 Hz (450 ms period)
60 kHz	2.2 Hz (450 ms period)
4 kHz	0.5 Hz (2000 ms period)

TABLE A (Cont)

CE-71 SPECIFICATIONS

ITEM	CHARACTERISTICS	
DISPLAY LINEARITY (Horizontal Deflection)		
Sweepwidth	25°C ±5°C (% of full scale)	0°C to +55°C
25 MHz	±3%	±4%
10 MHz	±5%	±10%
3 MHz	±5%	±10%
300 kHz	±2%	±2%
60 kHz	±2%	±2%
4 kHz	±5%	±8%
LOCAL OSCILLATOR INPUTS/OUTPUTS	Into 50Ω	
A 50.7–75.7 MHz 1st LO Input from CE-70	> -13 dBm	
C 50.7–75.7 MHz 1st LO Input from CE-70	> -13 dBm	
E 50.7–75.7 MHz 1st LO Output to CE-70	> -13 dB	
F 50.7–75.7 MHz 1st LO Output to CE-72	> -13 dB	
CATHODE RAY TUBE		
Size	5 inch diameter	
Phosphor	p7	
Persistence	Long, after filtration, yellow component only	
Graticule	6 cm x 10 cm	
IF INPUT (Nominal)		
Impedance	600Ω	
Center Frequency	80 kHz	
Level, 0 dB Display	-50 dBm	
REMOTE CONTROL MODE OF OPERATION		
Levelmeter Manual/Sweep		
Sweep	Ground on center conductor of IF input connector D	
Manual	Open or +5V on center conductor D	

TABLE A (Cont)

CE-71 SPECIFICATIONS

ITEM	CHARACTERISTICS
Signal Generator Manual/Sweep	
Sweep	Ground on center conductor LO output connector F
Manual	Open or +5V on center conductor F
HI LEVEL ALARM OUTPUT (Rear panel banana jacks)	
Alarm Condition	Dry contacts, contact closed
Contact Rating	1A at 125V AC
HI LEVEL ALARM TRIGGER LEVEL	
Sweepwidths 4 kHz to 10 MHz	
10 dB/DIV mode	+1.0 dB graticule ±2.5 dB
1 dB/DIV mode	+0.1 dB graticule ±1 dB
POWER REQUIREMENTS	115/230V AC ±10%, switchable 50-60 Hz, 70 VA nominal
DIMENSIONS	7 3/4" (19.7 cm) H, 17 3/4" (45.1 cm) W, 22" (55.9 cm) D
WEIGHT	45 lbs.
ENVIRONMENTAL	
Temperature	
Operating	0°C to +55°C
Storage	-40°C to +75°C

2. INSTALLATION

UNPACKING AND INSPECTION

2.01 When unpacking the CE-71 Spectrum Display, inspect the packing box and instrument for signs of possible damage. Verify satisfactory performance as outlined in the operating instructions (Section 3) of this manual. If the instrument is damaged, fails to operate properly or if any of the accessories are missing, file a claim with the transportation agency, or, if insured separately, with the insurance company.

POWER REQUIREMENTS

2.02 The CE-71 operates from a 115 or 230 volt (± 10%) AC source, 50 to 60 Hz with a nominal 70 VA input. A 1 1/2A SB (3/4A SB for 230V AC) fuse provides protection.

GROUNDING REQUIREMENTS

2.03 The CE-71 is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. To preserve this protection when operating the instrument from a two-wire outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

WARM UP REQUIREMENTS

2.04 There are no special warm-up requirements for the CE-71. The instrument is ready for use as soon as power is applied and the CRT trace is visible.

REPAIR SERVICE

2.05 In the event that repair is required, contact:

Cushman Electronics, Inc.
Customer Service Department
2450 N. First St.
San Jose, Calif. 95131
Telephone: (408) 263-8100
TXW: 910-338-0556

2.06 Cushman Electronics repair service is also available at the following service centers:

Domestic Service Centers

B.C.S. Associates, Inc.
940 North Fern Creek Ave.
Orlando, Florida 32803
Telephone: (305) 896-4881
TWX: 810-850-0185

B.C.S. Associates, Inc.
1310 Beaman Place
Greensboro, North Carolina 27408
Telephone: (919) 273-1918
TWX: 510-925-1173

Reshal Associates, Inc.
219 West University Drive
Arlington Heights, Illinois 60004
Telephone: (312) 398-7660
TWX: 910-687-2824

International Service Centers

Dana Electronics, Ltd.
112, Collingdon Street
Luton, Bedfordshire, England
TELEX: 851-82430

Tele-Radio Systems, Ltd.
301 Supertest Road
Downsview P.O.
Toronto, Ontario, Canada M3J 2M4
Telephone: (416) 661-3221
TWX: 610-492-2384

Preparation for Reshipment

2.07 It is recommended that the shipping box and foam packaging be kept in case it becomes necessary to return the instrument to the factory or the service center for service or repair.

2.08 The following paragraphs contain a general guide for repackaging of the instrument for shipment.

(a) Attach a tag to the instrument identifying the owner, and indicate the service or repair to be made. Include the model number and full serial number of the instrument. In any correspondence, identify the instrument by model and serial number.

(b) Place the instrument in the original container. Make certain that the container is well sealed with strong tape.

(c) If the original container is not used, wrap the instrument in plastic or heavy paper before placing in an inner container.

(d) Place packing material around all sides of the instrument.

(e) Place the instrument and inner container in a heavy carton and seal with strong tape.

(f) Mark the shipping container: "DELICATE ELECTRONIC INSTRUMENT", "FRAGILE.".

3. OPERATION

CONTROLS AND INDICATORS

3.01 The location of the front and rear panel controls and indicators is illustrated in Figures 2 and 3. A brief description of the front panel controls and indicators is given in Table B. The rear panel controls and connectors are described in Table C.

TABLE B

FRONT PANEL CONTROLS AND INDICATORS

REF NO.	CONTROL OR INDICATOR	FUNCTION
1	Graticule	Indicates display levels
2	Focus	Adjusts trace sharpness at center
3	Intensity	Controls brightness of trace
4	CAL	Calibrates amplitude in 10 dB/DIV only
5	Marker	Provides pulse marker on display at frequency to which CE-70 is set
6	Sensitivity	
	10 dB/DIV	Vertical 10 dB/DIV amplitude sensitivity selection
	1 dB/DIV	Vertical 1 dB/DIV amplitude sensitivity selection
7	Position	Vertically positions display in 1 dB/DIV mode only
8	Horizontal Position	Positions the display horizontally on the CRT screen
9	kHz/DIV CHANNELS	Selects sweepwidths to be displayed. Sweepwidths: 0.4, 6, 30, 300, 1000, 2500 kHz/DIV. (Channels: 1, 12, 60, 600, 1800, 3600.)
10	Tune	Adjusts position of spot across CRT in Manual position of sweep switch.
11	Sig Gen	
	Sweep	CE-72 tracks the CE-70 over the selected bandwidth with CE-71 generated LO. CE-72 in EXT mode.
	Manual	Selects independent operation of the CE-72.
12	Sweep	
	Single	Provides a single sweep when the Push-to-Start button is depressed.
	Cont	Provides continuously recurring display.
	Manual	Provides manually swept display.

TABLE B (Cont)

FRONT PANEL CONTROLS AND INDICATORS

REF NO.	CONTROL OR INDICATOR	FUNCTION
13	Levelmeter	
	Sweep	Swept display of signal input to CE-70, over selected bandwidth, controlled by CE-71 generated LO
	Manual	Selects independent operation of the CE-70. Blanks CE-71 display
14	Standby	Lights whenever Levelmeter switch is in Manual position.
15	Push to Start	Starts single trace sweep
16	Hi Level Alarm	Controls hi level alarm function
17	Alarm	Lights to indicate signal has exceeded 0 dB level set on CRT display for three successive sweeps.
	Push to Reset	Turns off Alarm light and resets alarm circuits
18	Scale	Controls brightness of scale illumination lights
19	Astig	Adjusts trace sharpness at ends.

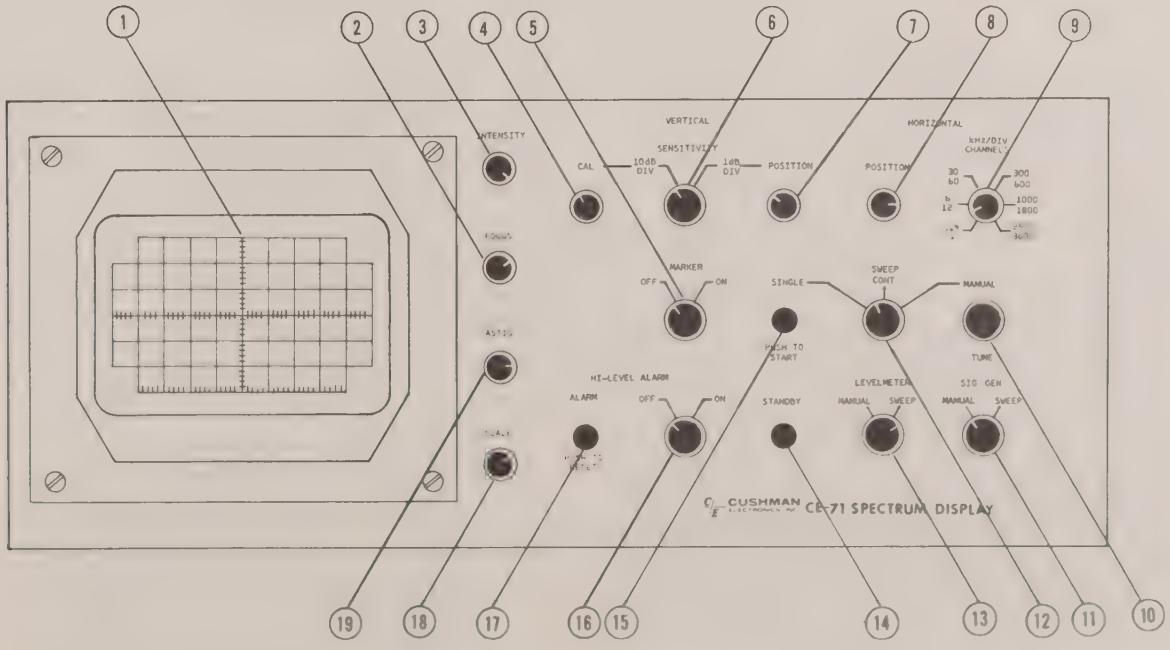

Figure 2. Front Panel Controls and Indicators

TABLE C

REAR PANEL CONTROLS AND CONNECTORS

REF NO.	CONTROL OR CONNECTOR	FUNCTION
1	D	80 kHz IF input from CE-70
2	C	50.7-75.7 MHz 1st LO Input from CE-70 if CE-72 is connected
3	A	50.7-75.7 MHz 1st LO Input from CE-70
4	E	50.7-75.7 MHz 1st LO Output to CE-70
5	F	50.7-75.7 MHz 1st LO Output to CE-72
6	115/230	Selects either 115V or 230V AC power source
7	Fuse	1 1/2A SB for 115V, 3/4A SB for 230V
8	Hi Level Alarm	Connected to floating contacts of relay. Relay contacts closed when front panel Alarm light is on.

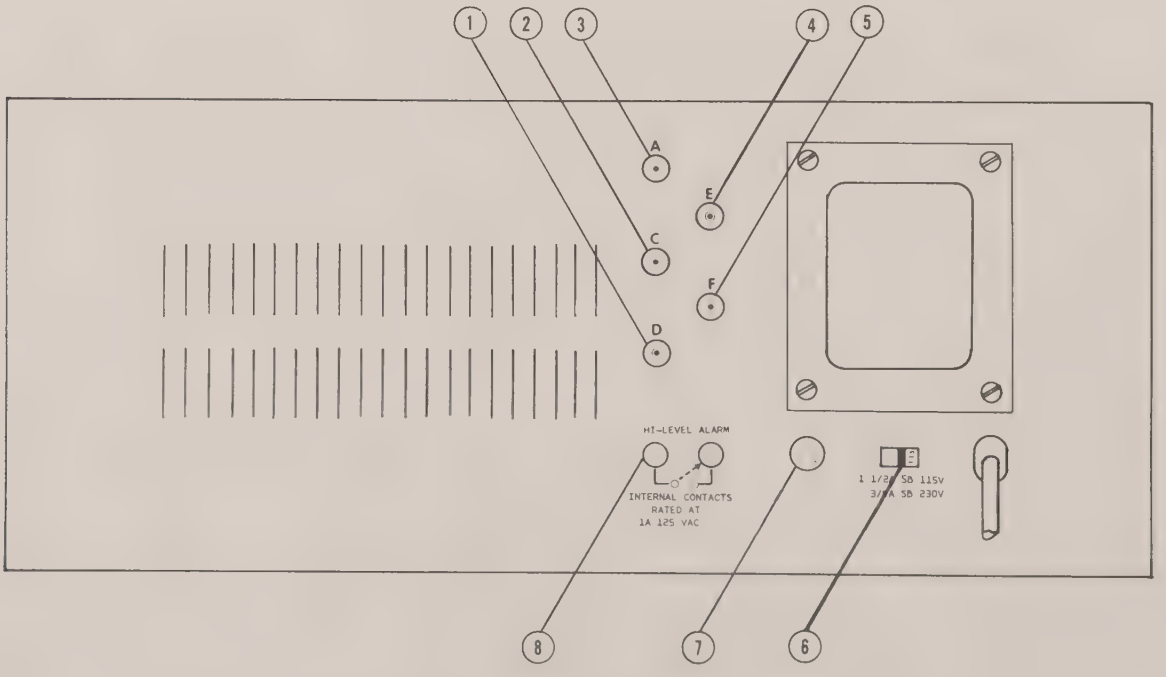

Figure 3. Rear Panel Controls and Connectors

OPERATION

3.02 The CE-71 may be operated with the CE-70 alone or with the CE-70 and CE-72 as a Transmission Test System.

CE-71 Operation With the CE-70

3.03 At the rear panel of the instruments:

(a) Check that the 115/230V switch is in the proper position for the AC power source to be used. The voltage to which the switch is set will be visible on the switch.

(b) On the rear panels, connect the 50 ohm coax cables provided with the instruments to the connectors having the same black letter indicators. Figure 5.

(c) Connect the CE-71 power cord to the SWITCHED line output on the CE-70. Connect the CE-70 power cord to the AC source. AC power to the two instruments is now controlled by the power switch on the CE-70.

(d) Turn the CE-70 PWR switch on. Adjust INTENSITY for a comfortable viewing of the CRT display trace. Do not set for a brightness greater than necessary as an excessive level may burn the CRT phosphor. Adjust FOCUS and ASTIG for a fine sharp trace. Set SCALE for suitable graticule illumination.

Note: An internal modification must be made to the CE-70 before it can be used with the CE-71. Afterwards an external coax jumper must be used, from red A to red A, when the CE-70 is used by itself. This modification is made automatically at the factory when the two instruments are ordered together.

3.04 Calibrate the CE-71 to the CE-70:

(a) Depress the PUSH TO CAL switch on the CE-70.

(b) Set the CE-71 controls as follows:

VERTICAL SENSITIVITY	10 dB/DIV
HI LEVEL ALARM	OFF
MARKER	OFF
kHz/DIV	30 kHz
SWEEP	CONT
LEVELMETER	SWEEP

(c) Adjust the CE-71 CAL control until the signal trace on the CRT screen comes up to the 0 dB line on the graticule.

(d) Release the PUSH TO CAL button on the CE-70.

3.05 At the CE-70 front panel:

(a) Select the input conditions by depressing IMPEDANCE Ω switch for proper line impedance.

(b) Set the LEVEL controls for the expected signal level.

(c) Set the Frequency selector controls to a frequency in the center of the bandwidth to be displayed.

(d) Connect the circuit to be tested to the proper CE-70 input using patchcords having compatible connectors.

(e) Turn the TONE/NOISE switch to TONE. If mixer overloading is caused by strong adjacent channel signals, turn the switch to NOISE. (Overloading will be shown by a large increase in level reading with a small increase in sensitivity.)

3.06 At the CE-71 front panel:

(a) Set the LEVELMETER switch to SWEEP position. (In the MANUAL position the CE-70 operates entirely independently of the CE-71 and the STANDBY light is lighted.)

(b) Set the SWEEP switch to either CONT, SINGLE or MANUAL. The CONT mode provides a constantly recurring sweep. In the SINGLE mode the sweep does not start until the PUSH TO START button/light is depressed. In the MANUAL mode the CRT beam is moved across the screen by adjusting the TUNE control.

(c) Set the kHz/DIV (CHANNELS) switch to the bandwidth to be observed. (The blue CHANNELS markings indicate the number of voice channels that may exist within that bandwidth.) Center the display by adjusting the HORIZONTAL POSITION control. The center frequency will be the frequency to which the CE-70 is set. See step 3.08.

3.07 To amplify the amplitude of the displayed signal by a factor of ten:

(a) With the VERTICAL SENSITIVITY switch in the 10 dB/DIV position, set the signal to approximately the desired level on the CRT screen.

(b) Set the Vertical SENSITIVITY switch to 1 dB/DIV.

(c) Adjust the VERTICAL POSITION control to view the desired 6 dB section of the signal.

3.08 To determine the frequency of any point on the signal using the Marker:

(a) Turn the MARKER switch to ON.

(b) Adjust the frequency of the CE-70 until the desired point on the signal falls on the Marker. The frequency to which the CE-70 is set is the frequency indicated by the Marker.

3.09 To obtain a front panel indication that the signal exceeds the 0 dB line on the CRT graticule for three successive sweeps:

(a) Set the desired signal level peak to the 0 dB line on the CRT graticule by adjusting the LEVEL controls of the CE-70. It must be the highest peak in the bandwidth scanned.

(b) Set the HI LEVEL ALARM switch to ON.

(c) Three successive signal sweeps that exceed 0 dB level line will cause the ALARM light to come on. The relay contacts across the HI LEVEL ALARM binding posts on the rear panel will also close. An audible alarm having its own power source may be connected to these posts to give an audible indication.

(d) The alarm circuits are reset (light turned off and relay contacts opened) by depressing the PUSH TO RESET button, or by returning the HIGH LEVEL ALARM switch to OFF.

(e) The LO signal appearing on the left end of the trace will trigger the HI LEVEL ALARM. (The amplitude of the LO signal is not affected by the CE-70 LEVEL controls.) To prevent this false alarm triggering, adjust the LO signal off the screen to the left with the HORIZONTAL POSITION control.

CE-71 Operation With the CE-70 and CE-72

3.10 At the rear panel of the instruments:

(a) Check that the 115/230V switch is in the proper position for the AC power source to be used. The voltage to which the switch is set will be visible on the switch.

(b) Stack the instruments with the CE-72 on the bottom, the CE-70 in the middle and the CE-71 on top. The lengths of the coax cables are made for this stacking order. Figure 4.

(c) Connect the six coax cables provided with the instruments to the connectors on each instrument having the same black letter indicators.

(d) Connect the CE-71 AC line cord to the LINE OUT receptacle on the CE-70. Connect the CE-70 AC line cord to the AC source. AC power to the two instruments is now controlled by the CE-70 PWR switch. Connect the CE-72 AC line cord to the AC source.

Note: An internal modification must be made to the CE-70 before it can be used with the CE-71 and CE-72. Afterwards an external coax jumper must be used, from red A to red A, when the CE-70 is used by itself. This modification is made automatically at the factory when the three instruments are ordered together.

3.11 Turn the instruments on with the CE-70 and CE-72 PWR switches. Adjust INTENSITY control on the CE-71 for a comfortable viewing level of the CRT display trace (if LEVELMETER switch is in SWEEP position). Do not set for greater brightness than is necessary as an excessive level may burn the CRT phosphor. Adjust FOCUS and ASTIG for a fine sharp trace. Set SCALE for suitable graticule illumination.

3.12 Calibrate the CE-71 to the CE-70 according to paragraph 3.04 a-d.

3.13 Set the CE-72 front panel controls as follows:

(a) Turn the POWER switch to ON.

(b) Turn the OUTPUT switch to OFF. The output, meter and display is controlled by this switch without turning the instrument off.

(c) Set the TUNING mode switch to EXT. In this mode the CE-72 tracks with the CE-70.

(d) Select the proper output impedance and connect the loop or equipment to be tested to the proper jack, using a patch cord with the proper connectors.

(e) Turn the output control to ON. Set the output amplitude with the LEVEL switches. Set the Meter to 0 dB with the FINE control.

3.14 Set the CE-70 and the CE-71 controls according to paragraphs 3.05 and 3.06.

(a) Set the CE-71 SIG GEN control to MANUAL for single signal output from the CE-72 at the same frequency as the CE-70 frequency setting.

(b) Set the CE-71 SIG GEN control to SWEEP for a CE-72 output frequency that is swept across the bandwidth of the CE-71 kHz/DIV switch setting and centered on the CE-70 frequency setting.

(c) To tune the CE-72 independently, turn the CE-71 SIG GEN control to MANUAL and the CE-72 TUNING control to INT. The frequency indicator lights now come on and the CE-72 may be set to any desired frequency by setting the FREQUENCY controls.

3.15 Connect the output of the loop or equipment to the input of the CE-70 and proceed according to paragraphs 3.07-3.09.

SWEPT DISPLAYS

3.16 When the CE-71 and CE-70 are used together, a swept display is obtained by making the appropriate setup of paragraphs 3.03 to 3.09 and setting the LEVELMETER switch on the CE-71 to SWEEP, and setting the CHANNELS switch to the range covering the channel or group of channels to be observed. When the CE-70 BFO output is connected to the input of the loop or equipment under test, a transmission loss or frequency response display is obtained. Procedure is the same as when using the CE-72, CE-71, CE-70, except that the CE-70 BFO output, at 0 dBm, connected through an attenuator if necessary, is used in place of the CE-72.

3.17 The 0 dB mark on the CE-71 graticule will indicate the level to which the CE-70 LEVEL controls are set (after Calibration, paragraph 3.04), and the Marker, if used, will indicate the frequency to which the CE-70 is tuned. The frequency and level of pilots, hot tones, interference or channels in use may thus be observed and missing channels identified.

3.18 When the CE-71, CE-70 and CE-72 are connected together in the TTS setup, (paragraph 3.10-3.15) the CE-70 may be tuned to the center of an idle channel or group and both the LEVELMETER and SIG GEN switches on the CE-71 set to SWEEP. The CE-72 must also be set to EXT. The Output of the CE-72 is connected to the input of the loop or equipment to be tested and the loop or equipment output is connected to the CE-70 input. When the CE-72 OUTPUT switch is set to ON a frequency response curve will appear on the CE-71 CRT screen when the CE-70 LEVEL is properly set.

Note: The Marker always appears on the trace at the frequency to which the CE-70 is tuned. On all CHANNEL settings except 3600, the Marker will be at the center of the trace. The Marker may be set to the center of the graticule by adjusting the HORIZONTAL POSITION control. On the 3600 CHANNEL setting the Marker appears on the trace at the Frequency to which the CE-70 is set and may be moved along the trace by adjusting the CE-70 Frequency.

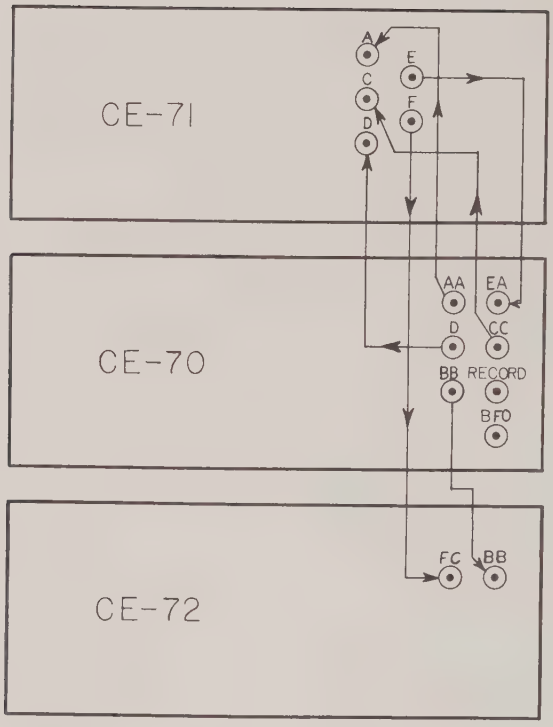

Figure 4. CE-70, CE-71, and CE-72 Rear Panel Connections

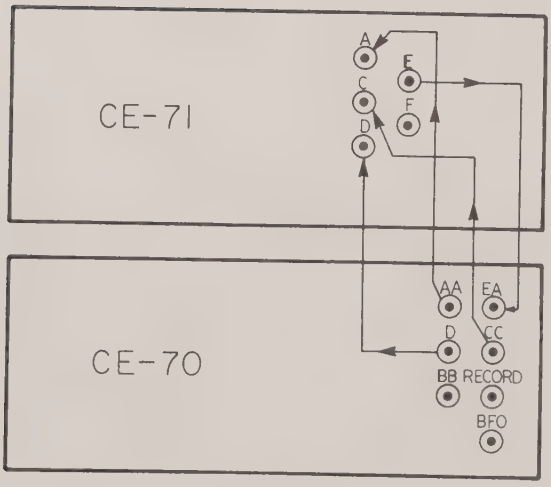

Figure 5. CE-70 and CE-71 Rear Panel Connections

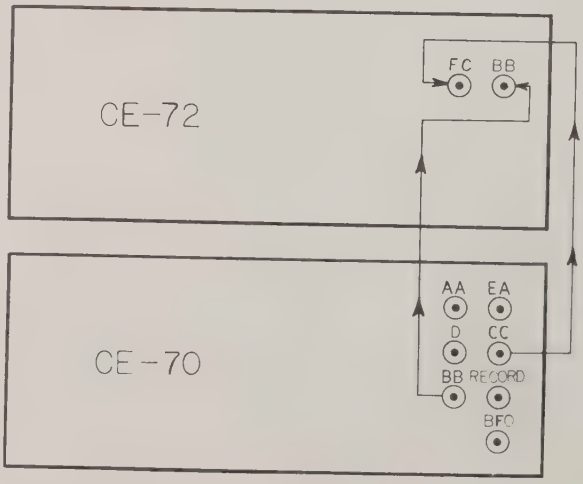

Figure 6. CE-70 and CE-72 Rear Panel Connections

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